

# Evolution

## *A Scientific Theory*

- Must make predictions.
- Must be in agreement with the evidence and be the best explanatory model.
- Must be verifiable – potentially falsifiable (capable of being tested).

# *A Scientific Theory* is not “flawed” or invalid when . . .

- it cannot account for an observation
- it is incomplete
- a particular piece of evidence can not be found

**ALL Scientific Theories are Incomplete**

<https://www.youtube.com/watch?v=TxaM0P8Fyu4>

# The Theory of Evolution

## ***Who believes in evolution?....***

This is not a valid question, our understanding of evolution is not a belief! Evolution has been well documented using vast bodies of evidence.

## ***Why is evolution considered a THEORY?***

A theory is accepted as a valid explanation of our observations, however, it can still be revised and as new evidence is gathered.

# Types of Evidence

What we are going to look at:

1. Direct Observation of Evolution

2. Fossil Record

3. Biogeography – past and present

(the branch of biology that deals with the geographical distribution of plants and animals)

4. Anatomical Evidence

5. Genetics & Population dynamics

# Fossil Record

- Most common and easy recognized fossils are such hard body parts as shells, bones and teeth
- Also includes impressions of burrows, footprints and even chemical remains
- Commonly formed when bodies of organisms become trapped in sediments, which become compressed into strata, or layers, and eventually harden into sedimentary rock

# Museum of Nature



- The cells may be replaced by minerals, resulting in permineralized fossil.
- Other rare conditions prevent most decomposition, organisms may be preserved nearly intact; such fossils have been found in tar pits, volcanic ash, peat bogs, permanently frozen ground and amber.





Fossil of a *Teloceras* in volcanic ash.





- **Most animals did not fossilize**; they simply decayed and were lost from the fossil record. Paleontologists estimate that only a small percentage of the dinosaur genera that ever lived have been or will be found as fossils.
- Think about it..... Would soft body organisms fossilize?

# Age of Earth

- Physicist Lord William Thomson Kelvin in 1866 earth was 400 million years old (calculations).
- Revised it to 15 to 20 million years
- Pierre Curie 1903 – discovered radioactive decay (provided geologists with means to estimate the age of Earth with greater precision).
- Earth about 4.6 billion years old

# Radiometric Dating

- Radioisotopes are atoms that undergo radioactive decay and their decay can be measured very accurately.
- The decay of radioactive material changes a parent isotope into a daughter isotope.
- Radioisotopes decay at their own constant rate

# Radioisotopes Used in Radiometric Dating

Parent Isotope	Daughter Isotopes	Half-life (years)	Effective dating (range)
Carbon 14	Nitrogen 14	5730	100 to 100 000
Uranium 235	Lead 207	713 million	10 million to 4.6 billion
Potassium 40	Argon 40 and calcium 40	1.3 billion	100 000 to 4.6 billion